

## Finding Gear Ratios

### What are Gears?

Gears are wheels with teeth. Gears mesh together and make things turn. Gears are used to transfer motion or power from one moving part to another.

### Why do we care?

Sports cars go fast (have speed) but cannot pull any weight. Big trucks can pull heavy loads (have power), but cannot go fast. Gears cause this. Gears increase or decrease the power or speed, but you cannot



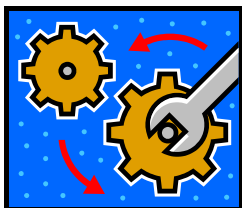
### Stuff to know about gears.

The gear attached to the motor is called the *primary gear* or *driver gear*. The motor turns this gear and it makes the second gear turn in the opposite direction.

The second gear is called the *secondary gear* or *follower gear*.

The *speed* of a gear is number of revolutions it makes per minute (rpm).

### Science Stuff about gears.

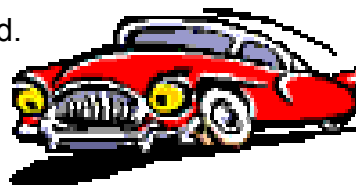


The diameter of the gears has a lot to do with the speed of the gear and the amount of *force* needed to turn the gears. The force is called *torque*.

Reducing the number of revolutions is called *gear reduction* (high torque). Increasing the number of revolutions is called *gearing up* (high speed).

### Math Stuff about gears.

*Gear ratios* are used to increase the force or speed.



The gear ratio is the:

**[number of turns of the driver ]: [number of turns of the follower].**

Example 2:1

**Student Activity:****Build it:**

Build a set of gears as shown below using a 24 tooth and 40 tooth gear.

Put an axle through the both gears and attach it to a support beam. Use a marker to make a small line on the side of each gear so you can count the number of times each gear completes one full revolution.

**Investigate Basics:**

1. You will use the large gear as the driver gear. Use the axle to turn the large gear to the right.



1. Which way does the small gear turn?
2. Does the follower gear turn faster or slower than the primary gear?

2. Use the small gear as it as your driver gear. Use the axle to turn it to the right.



1. Which way does the large gear turn?
2. Does the follower gear turn faster or slower than the primary gear?

**Gear Speed:**

1. Use the mark on the side of the gears to help you find the gear speed. Use the large gear as the driver and count how many times the follower gear turns when you turn the driver one full revolution.

Driver makes 1 turn and the follower makes \_\_\_\_\_ turns.

The gear ratio is 1:\_\_\_\_\_.

2. Switch and make the small gear the driver. Now what is the gear ratio.

Driver makes 1 turn and the follower makes \_\_\_\_\_ turns.

The gear ratio is 1:\_\_\_\_\_.

**Concept Questions:**

1. Which took more force to turn, the large gear or the small gear?
2. Try stopping it with your hand.
3. Which took more force (torque)?
4. Which ratio gives more power? More speed?

**Extension:**

1. Add more gears and repeat the investigation with three gears.
2. Try it with a different gear combination.
3. Make a chart of different gears and gear ratios. Indicate which gear ratios would be useful for heavy loads, going over rough terrain, or going fast.

**Gear Ratios**

<b># Teeth Driver Gear</b>	<b># Teeth Follower Gear</b>	<b>Gear Ratio</b>	<b>Best Use</b>

